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Preliminary

Effect of Hexaflumuron on the Two Major Japanese Subterranean Termites, *Coptotermes formosanus* Shiraki and *Reticulitermes speratus* (Kolbe)*[1]

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Although hexaflumuron has been commercialized as a bait toxicant to eradicate or suppress termite infestation in the United States, only limited information is available for its applicability to termite control in Japan. Current study is concerned with the effect of hexaflumuron on the two major Japanese subterranean termites, *Coptotermes formosanus* Shiraki and *Reticulitermes speratus* (Kolbe).

Colony elimination of *Coptotermes formosanus* Shiraki by baits containing hexaflumuron

A nest of *C. formosanus* was transferred into our test site and buried back into the ground on January 27, 1995. Forty-two wooden stakes were driven into the ground to concentrically surround the nest on the same day, and three more stakes were added to each original stake on April 19, 1995 so that 42 monitoring stations were installed, consisting of 4 closely spaced wooden stakes. Those monitoring stations were protected by unglazed flowerpots from over-wetting by rain and other environmental disturbance on July 4, 1996.

After termite activity of the transferred nest recovered, foraging population was estimated by a triple-mark-recapture program using Nile Blue A[1-3] as a dye marker during the period from July 31 to October 3, 1996. Foraging population was estimated at 271,200±49,600. The first bait application was then conducted from November 6, 1996 to December 3, 1997. Bait-tubes containing hexaflumuron replaced one of 4 wooden stakes at 3–7 stations and two commercial bait stations were set up among monitoring stations. Although no termites were present at any monitoring station on December 3, 1997, we did not conclude colony elimination because bait consumption (23 mg hexaflumuron) did not seem high enough to kill all colony members and no unsound termites with milky-white body color were observed. Therefore, a colony member identification box was connected to the test nest to examine whether termites collected from the monitoring stations following spring belonged to the test colony. As marked termites, which were collected from monitoring stations, marked and released backed to the stations, were present in the box, the test colony was not eliminated by the first baitings. The second estimation from April 28 to July 1, 1998 indicated that the foraging population decreased to 142,600±19,600. The second bait application was conducted from October 16, 1998 to July 28, 1999. Towards the end of the bait application, many termite individuals with milky-white body color were collected and finally no termite was present at any monitoring station on July 22 and July 28, 1998. We then concluded that the colony was terminated, and a careful examination of the recovered nest supported our conclusion. Total consumption of hexaflumuron amounted to 419 mg, which was equivalent to a consumption rate of 1.55 μg/termite individual.

Effect of worker instars of *Reticulitermes speratus* (Kolbe) on hexaflumuron-treated wood consumption

It is well known that workers of *R. speratus* readily differentiate into reproductive caste, and it seems possible for the species to establish a new colony when some workers are isolated from the rest of the colony members. However, no experimental data has been produced to determine which instar of workers can live on wood without any assistance of mature workers and start forming a new colony. Current research was planned to examine the effect of worker instars on the untreated and hexaflumuron-treated wood consumption. Identification of instars was based on the number of segments of antenna and head width. A group of each instar (30 individuals) was then forced to feed on either untreated or hexaflumuron-treated pine sapwood. Although small wood fragments were observed in their digestive organ regardless of worker instar under ultraviolet microscope when termites were fed on wood stained with ethidium bromide, it was not considered that younger workers (1st and 2nd instars) could digest wood because symbiotic protozoan fauna was not present in their hindgut and all test termites were dead by the end of 3-week incubation period. Workers older than 3rd instar could live longer with survival rates of over 65%, and wood consumption rates increased with age of the test workers when untreated wood was given as a single food source. Wood consumption rates were 29, 32 and 39 μg/termite/day for the 3rd, 4th and 5th instars, respectively.

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Effect of hexaflumuron was most noticeable with 3rd instar workers. The survival rates of them ranged from 76% for untreated wood to 40% for the highest concentration of hexaflumuron, 1,480 ppm in wood, although survival rates for untreated wood were not varied among worker instars. In contrast, hexaflumuron-treated wood did not give a remarkable effect to both 4th and 5th instars based on their survival rates, and caused little feeding deterrence to them at the test concentrations. However, symptoms of metamorphosis inhibition was observed with the both instars similarly to *C. formosanus*[4], and some body parts such as antennae and/or appendages were apparently cannibalized by other termite individuals during the test duration. These results appear to strongly support the applicability of hexaflumuron to the control of *R. speratus* due to little dose dependence and feeding deterrence of the chemical. Further studies, however, are needed to examine its slow-acting property that is essential as a bait toxicant.

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